

Acquisition of Software Intensive Systems Conference



Revitalizing the Software Acquisition Process

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Outline

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- n **Our History**
- n **Today's Environment**
- n **Plan for Improvement**
- n **Next Steps**
- n **Conclusions**



A Decade Ago...

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- n **DoD 5000.2, Part 6-D, *Computer Resources***
 - n Computer Resources Life-Cycle Management Plan (CRLCMP), Integrated system development, Software metrics, Software test management, Ada language policy, Software engineering practices
- n **Air Force Regulation (AFR) 800-14, Life Cycle Management of Computer Resources in Systems**
- n **AFMC Pamphlets**
 - n Software IV&V, Software Risk Abatement, Review of Software Requirements and Interface Requirements Specifications, Software Management Indicators, Software Quality Measurement, Software Development Capability Assessment
- n **SAF/AQ Memos**
 - n Software Engineering, Software Maturity Assessment, Ada, Metrics, Software Estimating, Software Reuse, Best Practices, Use of Software Development Capability Evaluation in Source Selection, Etc.



A Decade Ago...(Cont.)

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- n **Development standards**

- n DOD-STD-2167/2168, MIL-STD-498, MIL-STD-1803
- n MIL-STD-882, MIL-STD-490, MIL-STD-499, DOD-STD-1521

- n **Senior software engineer in each program office, supported with additional help, as necessary**

- n Depending on magnitude of software development effort, program phase, etc.

- n **Air Force Systems Acquisition School training**

- n Computer Resources Acquisition Course (CRAC)

In spite of all this, success was not guaranteed...



Today...

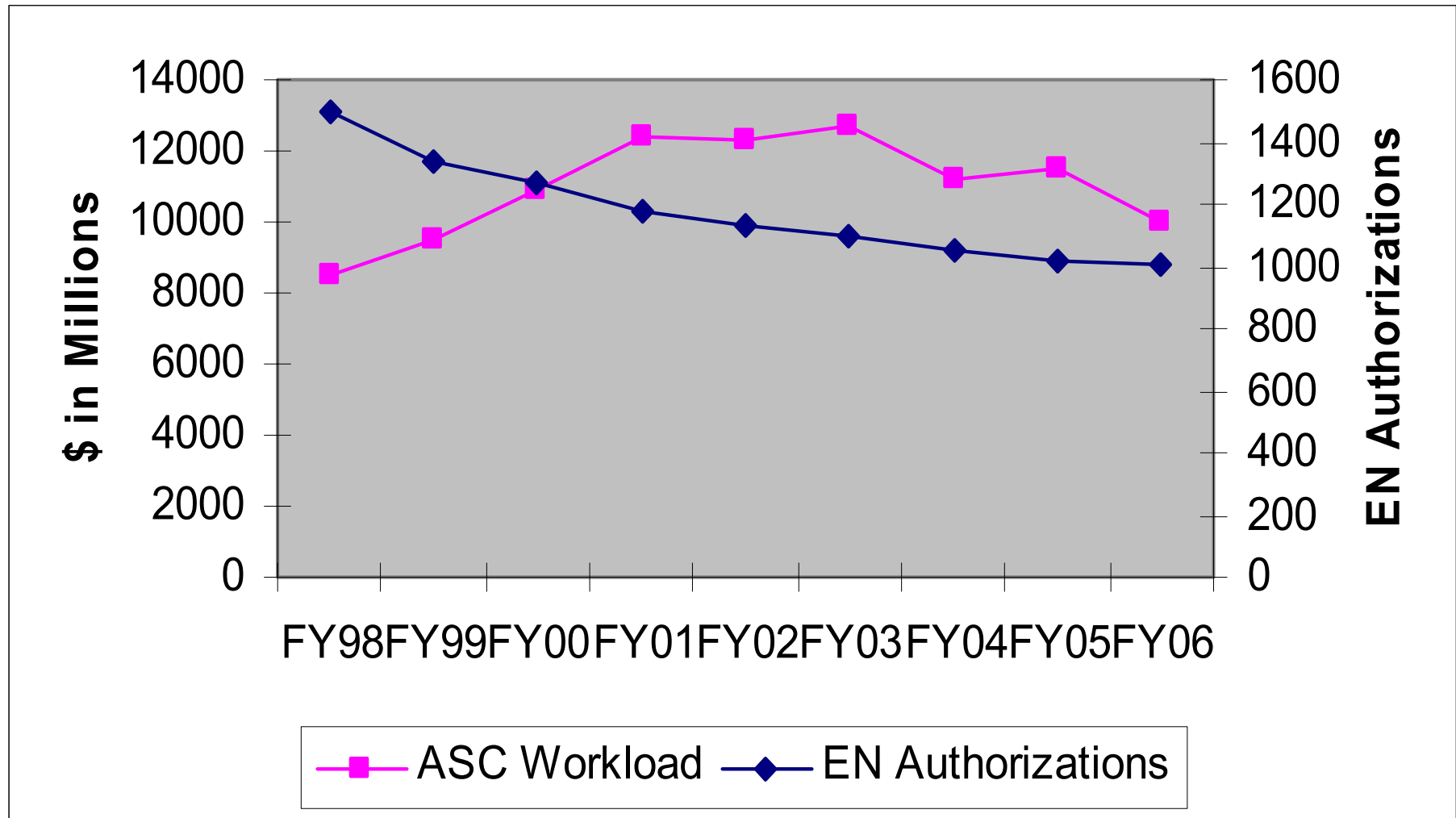
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- n **Limited policy / guidance specific to the acquisition of software intensive systems**
 - n Almost none of it mandatory
- n **No standard way of doing business**
 - n Processes across the acquisition enterprise have diverged
 - n Decreasing oversight / insight
- n **Lack of appreciation for process**
 - n Demands for reduced cycle time
- n **Training available through SAM courses**
 - n Data indicates limited exposure
- n **Aging and diminishing workforce**
 - n 10 year gap for new hires
 - n Acquisition workforce being rapidly downsized



ASC Workload and EN Staffing

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The Message(s) to PMs...

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The budget is \$x.
We need the system
in n months...

Use a disciplined systems
engineering process...

Implement software
acquisition process
improvements...

Be more
credible...

Take risks...

Transform...

Reduce
cycle times...

Deliver the
capability NOW!





A Sample of Findings from ASC Program Reviews

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- n **Incompatible / optimistic performance, effort, and schedule baselines**
- n **Deficiencies in requirements management**
- n **Inadequate risk identification and management**
- n **Processes set aside due to program pressures**
- n **Planned reuse not achieved**
- n **Program staffing problems**
- n **Failure to identify and react to problems**
- n **Inadequate program office insight**
- n **Labs not fully capable or not in place when needed**
- n **Fixed price development contracts with uncertain requirements or other significant risks**



An Issue Seen Too Frequently...

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Inability to establish compatible effort, schedule, and performance baselines

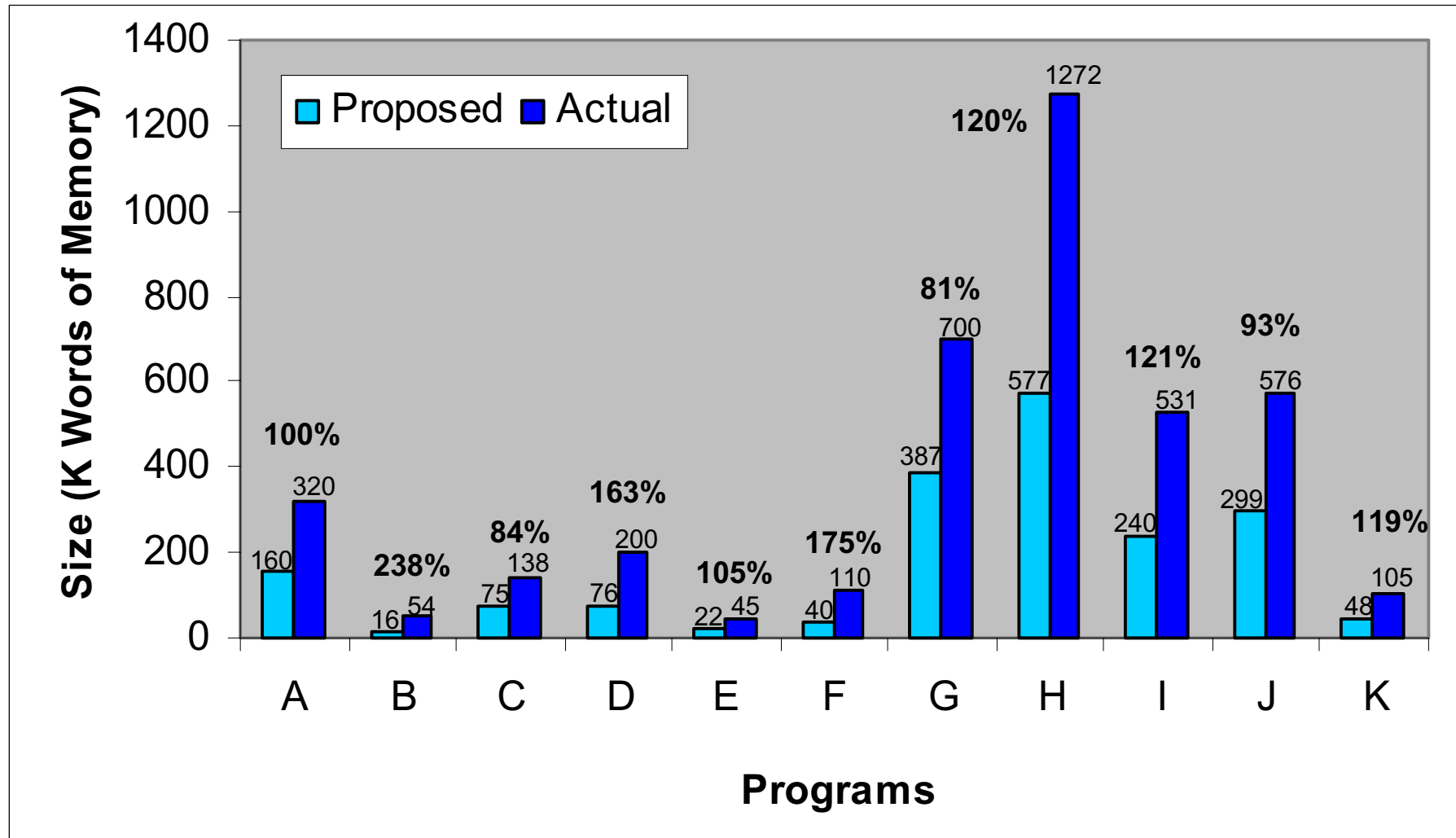
n Why?

- n Programs come with defined cost, schedule, and performance baselines, often (optimistically) determined without adequate insight into what actually needs to be done
- n All participants challenged to reduce cycle times, take risks, etc.
- n Requirements are not fully defined / stable
- n Difficult to estimate the size of a software development effort for unprecedented systems or where requirements are not complete
 - n Hence, difficult to estimate development effort and schedule
- n History indicates software size estimate grows significantly during development



Embedded Software Size Growth

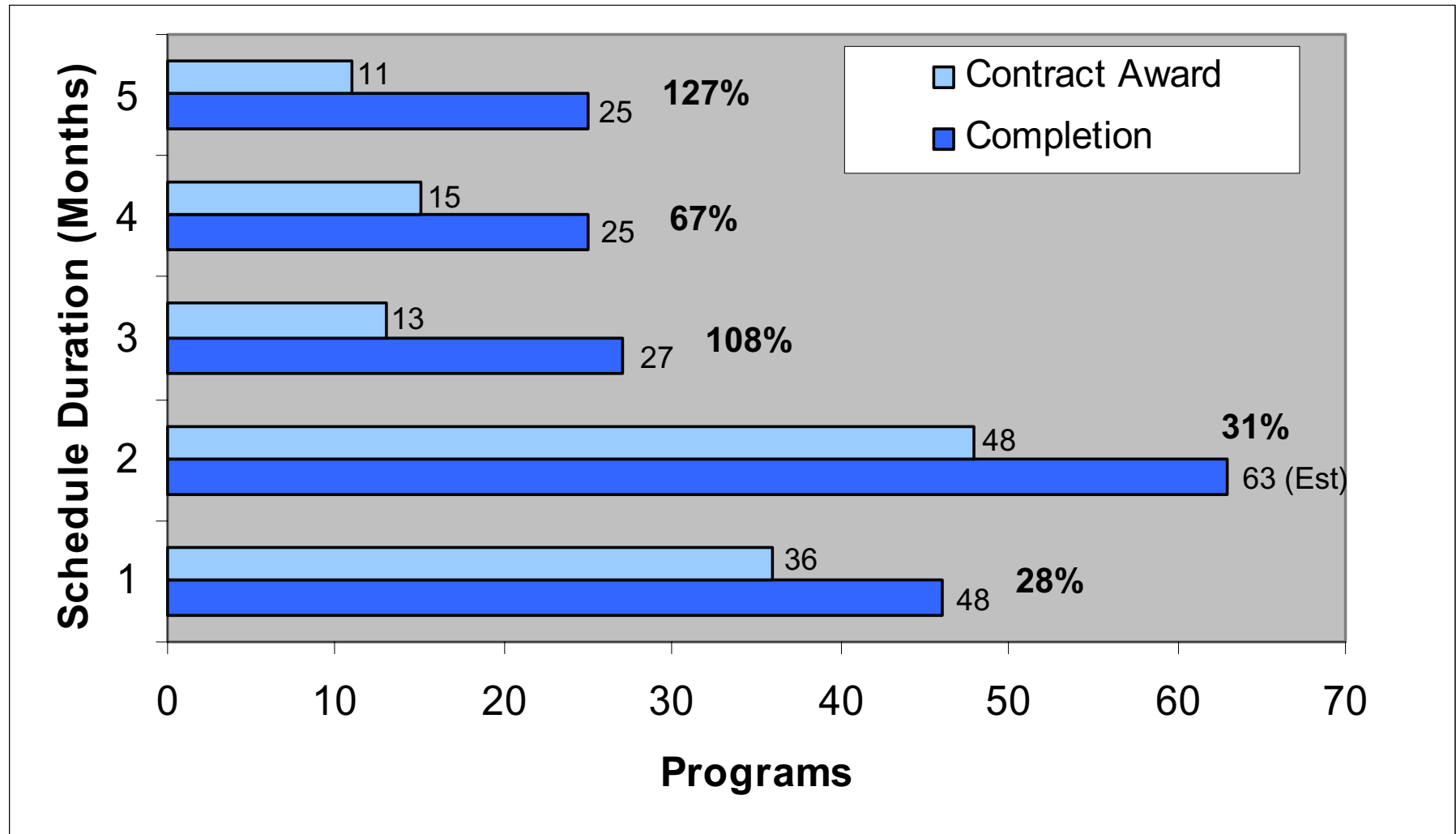
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Embedded Software Schedule Growth

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Plan for Improvement

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- n **ASC/EN initiative to document and improve systems engineering processes**
 - n Identify, define, & document technical processes
 - n Combine and simplify current processes
 - n Fully integrate internal processes
 - n Focus on government responsibilities
 - n Deploy
 - n Training, guidance, and monitoring
- n **Also considering independent look**
 - n Validation of selected processes by outside organization



Software Acquisition Approach

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- n **Document critical processes**
 - n Enterprise support activities
 - n Program-level activities (planning and execution)
- n **Develop training**
 - n Target to all who need to know - not just organic engineering
- n **Deploy and monitor application of processes**



Software Acquisition Approach (Cont.)

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n Organization

- n Enterprise (Center Level) Support (3)**
- n Acquisition Program Planning Processes (4)**
- n Acquisition Program Execution Processes (14)**

n Key practices addressed in acquisition strategy

n Each process documented with brief description

- | | |
|-------------------------------------|---|
| n Purpose | n Outputs / Products |
| n Roles and Responsibilities | n Available Tools / Techniques |
| n Key steps | n Potential Problem Areas / Pitfalls |
| n Inputs | n Lessons Learned |

n Appendices with additional detail as needed



Key Software Acquisition Practices

(To Be Addressed in Acquisition Strategy)

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- n **Establish Realistic and Compatible Program Baselines**
- n **Provide System Development and Demonstration (SDD) Phase Source Selection Support**
- n **Identify and Manage Computer System and Software Risks**
- n **Establish and Manage Software Requirements**
- n **Accommodate High-Assurance Systems**
- n **Ensure Application of Mature Development Processes**
- n **Maintain Technical Insight**



Enterprise Support

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- n **Provide Advice and Counsel**
 - n Pre-Acquisition Strategy Panel (ASP) Support
 - n Source Selection Consultation and Advice
 - n Ensure achievable baselines
 - n Program Execution
 - n Independent Reviews
- n **Manage Software Acquisition Training and Experience**
 - n Software Acquisition Engineering Training (Guidebook)
 - n Software Estimation Training
 - n Other special-topic training as required
- n **Collect and Disseminate Lessons Learned**
 - n Collect lessons learned at project/build completion
 - n Establish and maintain lessons learned database
 - n Disseminate lessons learned through briefings, training, etc.
 - n Implement needed process improvements



Acquisition Program Planning

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3.1 Develop Software Acquisition Strategy

- n Develop program approach to key software acquisition practices
- n Get informal, independent review prior to issuing RFP

3.2 Establish Realistic, Compatible Program Baselines

- n Estimate software development size (factoring in growth)
- n Estimate software development effort and schedule
- n Develop realistic estimate that balances risk, cycle time, etc.

3.3 Support Request for Proposal (RFP) Preparation

- n Provide key software considerations for RFP Sections L and M
- n Solicit and evaluate software size, effort, and schedule estimates
- n Solicit software development process documentation

3.4 Provide Source Selection Support

- n Evaluate developer capability
- n Evaluate proposed development processes
- n Evaluate proposed development plan
- n Assess compatibility of processes, plan, effort, and schedule



Program Level Execution

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4.1 Identify and Manage Software-Related Risks

- n Ensure effective risk management process is in place
- n Ensure all software-related risks are identified and managed

4.2 Establish and Manage Software Requirements

- n Ensure software requirements are defined, complete, verified, consistent and traceable

4.3 Address Training System Concurrency Requirements

- n Provide for the most efficient method to meet training system concurrency requirements

4.4 Establish Software Build Plan

- n Ensure there is a plan to define, develop, integrate, and deliver software increments in response to system requirements



Program Level Execution (Cont.)

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4.5 Accommodate Application and Sustainment of Non-Developmental Software (NDS)

- n Address COTS and other NDS integration

4.6 Accommodate Security Certification & Accreditation (C&A)

- n Ensure that confidentiality, integrity, and availability is maintained throughout the life-cycle of the system
- n Preclude compromise, exploitation, sabotage, and intentional damage and destruction

4.7 Accommodate Safety-Critical and High-Assurance Systems

- n Define the process, including what is expected of the developer, to specify, design, develop, integrate, and verify flight-critical and safety-critical systems



Program Level Execution (Cont.)

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4.8 Establish System / Software Engineering Environment (S/SEE) and Development and Integration Laboratories

- n Ensure development, integration, and verification environment requirements are fully defined
- n Ensure environments are in place when needed and can provide the required throughput

4.9 Ensure Application of Mature Development Processes

- n Assess developer team process capability prior to contract award to identify strengths, weaknesses, and risks
- n Support disciplined application of processes throughout the development effort



Program Level Execution (Cont.)

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4.10 Maintain Technical Insight and Resolve Development Issues

- n Implement effective means of communication on program status and issues
- n Take corrective action when necessary

4.11 Establish Software Product Engineering Data

- n Ensure the minimum set of engineering data and documentation required for the weapon system software is developed, acquired (or escrowed), and maintained

4.12 Conduct / Support Technical Reviews

- n Determine the types of reviews to be accomplished and the role of the acquisition organization
- n Establish relevant entry and exit criteria



Program Level Execution (Cont.)

ASC

4.13 Plan for Post Deployment Software Support

- n Identify source of support for all software elements
- n Determine expected rates of change and expected workload
- n Establish required support resources and facilities

4.14 Identify and Collect Lessons Learned

- n Survey project participants
- n Collect objective data
- n Share the results



Process Development Schedule

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- n Complete guidebook draft January 2003**
- n Complete coordination and review by SPOs and AFMC SISSG members February 2003**
- n Publish guidebook Version 1 February 2003**
- n Complete development of guidebook training March 2003**



Next Steps

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- n **Consider extending scope to AFMC**
 - n Address concerns of other domains
 - n Add sustainment processes
- n **Get leadership buy-in**
- n **Work with Air Force Institute of Technology (AFIT) to enhance training**
 - n Software Professional Development Program (SPDP)
 - n Acquisition-specific training
- n **Address Section 804 requirements**
- n **Incorporate improvements identified by independent process validation activities**



Conclusions

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- n **We understand the issues and are taking positive steps to set programs up to succeed**
- n **Revitalizing our processes is a crucial first step**
- n **We can't solve the problem by ourselves**
 - n Balance risk and credibility
 - n Support disciplined application of processes